Spring 2012

DroughtScape- Spring 2012

National Drought Mitigation Center

April 2012

National Drought Mitigation Center

DROUGHTSCAPE

The Newsletter of the National Drought Mitigation Center

DIRECTOR'S REPORT

Since the National Drought Mitigation Center was established in 1995, much of our focus has been on improving drought risk management within the United States. The NDMC also has a long history of international activities. In fact, our international involvement is increasing, and this issue of DroughtScape highlights several of these activities.

Every year, we see that drought can lead to tremendous economic hardship, threaten livelihoods, and even cause mortality in some locations. Droughts are linked to food insecurity, limited water resources, and general sustainability. The NDMC looks forward to partnering with organizations such as the United Nations Food and Agriculture Organization, the World Meteorological Organization, NASA, the National Integrated Drought Information System, USAID, the World Bank, and many others to find solutions and reduce future drought impacts around the world. To see more information regarding our international efforts, please turn to pages 9-12, and visit the NDMC's International Activities webpage -- *http://drought.unl.edu/International*.

Michael J. Hayes

Climate Masters to Spur Local Action to Reduce Emissions

Climate Masters of Nebraska will share proven ways to act locally to save money, protect the environment and reduce greenhouse gas emissions, say the organizers. It is a joint effort by the National Drought Mitigation Center, University of Nebraska–Lincoln Extension and the High Plains Regional Climate Center.

"When people hear about climate change, people think in terms of a global issue," said Tapan Pathak, Extension educator in climate variability, who is leading the project. "People get overwhelmed, and they think, 'What can I do?' This is an action-based program to help people understand what they can do that's good for people and for the environment."

Climate Masters

The project, funded by the U.S. Environmental Protection Agency, will teach 50 community volunteers various ways that they as individuals can reduce greenhouse gas emissions. In exchange, volunteers must commit to providing 30 hours of education to others in the community. Cleaner Greener Lincoln, the mayor's sustainability initiative, is a project partner.

The first 10-week Climate Masters course began in March 2012,

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Researchers found that the most active participants in Climate Masters reduced household greenhouse gas emissions by an average of about two tons per year.

Participants in the Climate Masters class, from left, Jenn Simons, Juliana Dai, and JoEllen Polzien, helped people calculate their household greenhouse gas emissions at Weatherfest 2012, March 31 in Lincoln, Neb.

meeting one evening per week, and will include field trips to locations such as a landfill, said Tonya Bernadt, NDMC education and outreach specialist. A second round of training will begin in January 2013.

Classes focus on the basics of climate change, home energy, transportation, green building, renewables, yards, consumption and waste, food, home water conservation, preparing for climate change, consultations and outreach, and offsets.

Wade Gregson, who works for the Nebraska Department of Environmental Quality, said he is participating in Climate Masters because, "I'm an environmentalist, and I'm always looking for ways to expand my horizons." He said that Climate Masters is giving him practical ways to help others live more sustainably.

Jenn Simons, an environmental studies and sociology major at UNL who is participating in Climate Masters, said, "Now I can actually go out and tell people, 'Here's what you can do to change.'" Plus, she added, "I know you should bike and recycle, but insulation is easier, if you have the funds, rather than committing to a lifestyle change."

"The City of Lincoln is pleased to support the Climate Masters program for several reasons," said Milo Mumgaard, senior policy aide for sustainability in the office of Lincoln Mayor Chris Beutler. "In particular, the program will enable community volunteers to be even more informed about how their day-to-day practices affect the environment, and how they can share this knowledge with others. Lincoln is proud of its high quality of life, and the Climate Masters program continues that tradition."

Climate Masters, which is similar to master gardener and master naturalist programs, started at the University of Oregon. Researchers there found that the most active participants in Climate Masters reduced household greenhouse gas emissions by an average of about two tons per year. Participants in the program will receive printed copies of course materials adapted for Nebraska.

For more information, please visit the Climate Masters website: *http://ClimateMasters.unl.edu*

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Kansas Ranchers Learn About Managing Drought Risk

The NDMC and the Kansas Graziers Association presented "Managing Drought Risk on the Ranch," Jan. 21, 2012, in Emporia, Kan., sponsored by the U.S. Department of Agriculture's Risk Management Agency. More than 100 rangeland managers participated.

Speakers included Barry Dunn, ranch management specialist and dean of Agriculture and Biological Sciences at South Dakota State University; Jerry Volesky, professor and range and forage systems specialist at the West Central Research and Extension Center in North Platte, Neb.; Ted Alexander, a Kansas rancher who operates according to a detailed management plan; David Kraft and Dwayne Rice, Kansas-based USDA Natural Resources Conservation Service range management specialists; Amy Roeder, USDA RMA risk management specialist in Kansas City; Charles Griffin, director of the Kansas Rural Family Helpline and research assistant professor in the School of Family Studies and Human Services at Kansas State University; and Mary Knapp, Kansas state climatologist. Speakers were supported through a grant from the U.S. Department of Agriculture's Risk Management Agency.

In addition to the Graziers and the RMA, sponsors and partner organizations included the Kansas Grazing Lands Coalition, the Kansas Rural Center, the Kansas Farmers Union, and the Kansas Center for Sustainable Ag and Alternative Crops.

To see presentations, audio recordings and more information, please visit the workshop page on the ranch planning website, *http://drought.unl.edu/ranchplan/Overview/Resources/EmporiaKansasJanuary212012.aspx*

Trade press coverage helped amplify the message:

Roger Gates covered it for the *Tri-State Livestock News*. "Develop plans for potential drought in 2012" was published Jan. 30, 2012. *http://www.tsln.com/article/20120130/TSLN01/120129901/1031&ParentProfile=1001*

"Planning can mitigate drought effect," by Mark Parker, appeared in the *High Plains/Midwest Ag Journal* in February. *http://www.hpj.com/archives/2012/feb12/feb27/0202GraziersWinterConferenc.cfm?title=Planning+can+mitigate+drought+effect*

The Drovers Cattle Network ran "Profit Tips: Business management – Website aids drought planning." *http://www.cattlenetwork.com/drovers/departments/129535838.html*

Top photo: *Amy Roeder, Risk Management Agency, gave a presentation on Pasture, Rangeland, Forage Crop Insurance.*

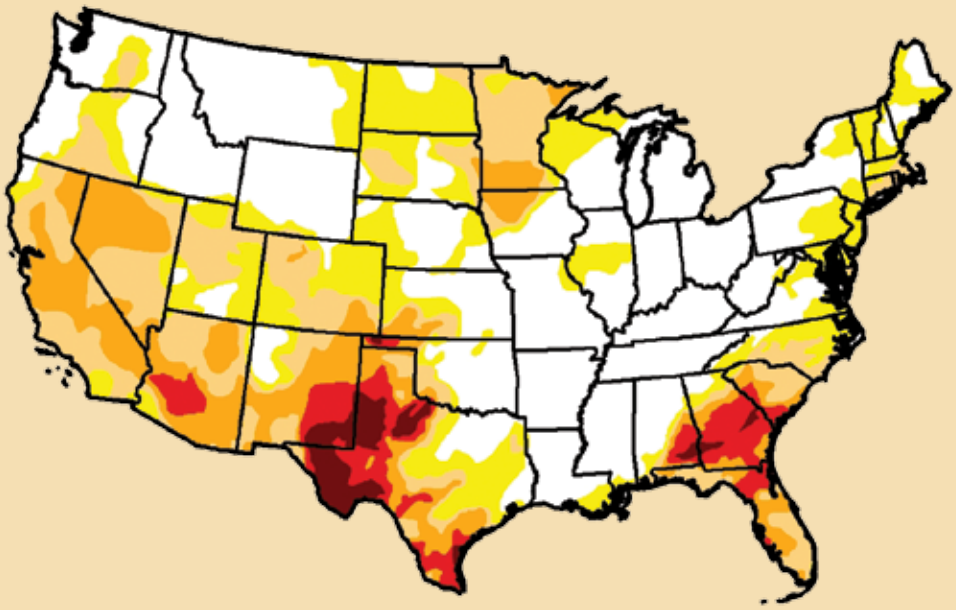
Middle photo: *Ted Alexander, a rancher with a well-developed drought plan, confers with a fellow producer.*

Bottom photo: *Tonya Haigh, left, of the NDMC, and Mary Howell, coordinator for the Kansas Graziers, collaborated on the workshop.*

Spring 2012 Ou

Drought classifications are based on the U.S. Drought Monitor. Details on the extent and severity of drought are online at *http://droughtmonitor.unl.edu/archive.html*. The outlook integrates existing conditions with forecasts from the National Oceanic and Atmospheric Administration's Climate Prediction Center: *http://www.cpc.ncep.noaa.gov/*

Outlook: The influence of the mild La Niña winter is rapidly diminishing, with neutral conditions expected through the end of spring and into summer. The spring outlook anticipates continued warm conditions along the southern United States and into the eastern portions of the country. Equal chances of above- or below-normal precipitation dominate the outlook. The only areas showing some chances of below-normal precipitation are in and along the Great Basin and the Gulf Coast. The Seasonal Drought Outlook — *http://www.cpc.ncep.noaa.gov/products/expert_assessment/seasonal_drought.html* -- shows improving conditions in the southern Plains, with drought persisting in the Southeast and Southwest. Some improvements in the Pacific Northwest and northern California may be warranted in response to rain and late snows in the region.



The U.S. Drought Monitor from March 27, 2012, showed 56 percent of the area of the United States abnormally dry or worse, and 36 percent in moderate or worse drought.

Week	Nothing	D0-D4	D1-D4	D2-D4	D3-D4	D4
January 3, 2012	50.41	49.59	31.90	18.83	10.18	3.32
March 27, 2012	43.56	56.44	35.93	19.40	6.72	2.15

This comparison of the Jan. 3 and March 27 U.S. Drought Monitor maps shows that the total area in drought increased in the first three months of the year, but the area in the most intense categories of drought decreased.

January: A very mild winter continued over much of the United States during January with temperatures above normal for almost the entire country. Over much of the northern Plains and upper Midwest, temperatures were 9-15 degrees Fahrenheit above normal for the month. Precipitation during the month was greatest over the southern Plains, stretching into the Ohio River Valley. Above-normal precipitation was also recorded over portions of the Pacific Northwest and Great Basin. Conditions were drier-than-normal along the Gulf Coast, from Louisiana into Georgia and South Carolina. Drought intensified and expanded during January, with 31.7 percent of the country in drought at the end of the month, compared to 26.7 percent at the start of the new year. Much of the emergence of drought took place in the western United States. Drought intensified into D4 (exceptional drought) over southern Georgia, and in northern Florida, drought intensified into D2 (severe) and D3 (extreme) during the month. Improvements to drought in the southern Plains occurred during January, with portions of Texas and Oklahoma recording enough rain to decrease the intensity of drought and even eliminate it in northeast Texas and eastern Oklahoma.

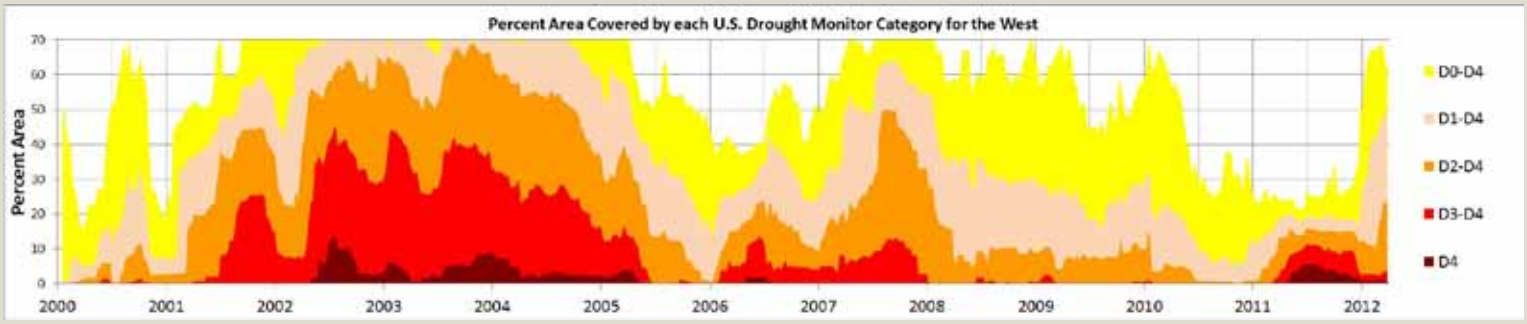
February: Temperatures remained well above normal over the eastern half of the United States in February. The warmest temperatures were again over the northern Plains, upper Midwest and New England, where temperatures were 6-10 degrees Fahrenheit above normal. Other areas to the south were 2-4 degrees Fahrenheit above normal. West of the Rocky

tlook and January to March 2012 Summary

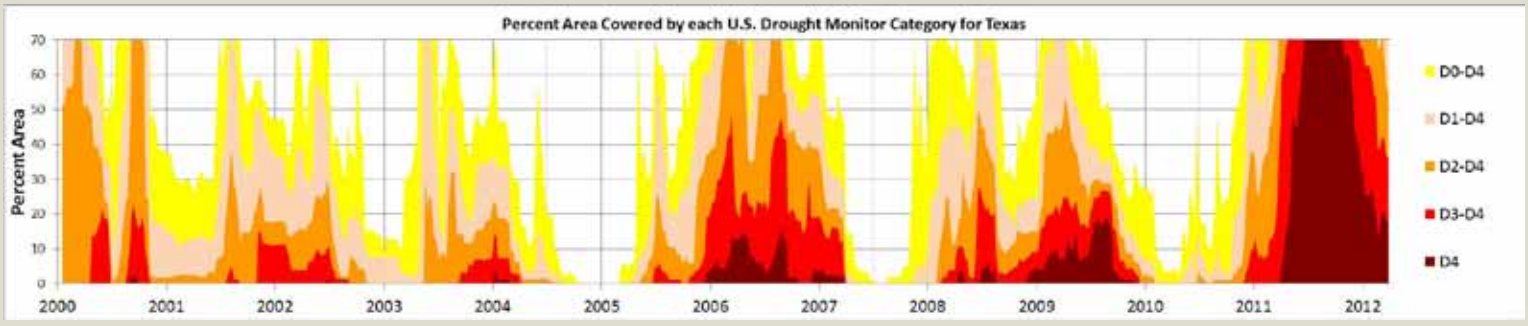
By Brian Fuchs, Climatologist, National Drought Mitigation Center

Mountains, temperatures were typically 2-4 degrees Fahrenheit below normal. Precipitation varied across the country during February, with the Plains states recording amounts up to 3 inches above normal. The pattern of above-normal precipitation continued in east Texas and Louisiana, where they had 8 to 14 inches of rain. Overall, drought got slightly worse during the month, with 32.4 percent of the country in drought at the end of February compared with 31.7 percent at the beginning of the month. But for the second straight month, the total area in D3 and D4 shrunk, with only 6.4 percent of the country in D3/D4 drought compared to 8.5 percent at the start of the year. The exception was in southern Georgia and northern Florida, where D3/D4 conditions expanded during the month. The western United States had a very dry start to the water year, with a large expansion of D2 covering portions of northern California and Nevada.

March: Winter came to an end and spring arrived early, emphasizing the story of the last several months -- the unseasonably warm weather throughout much of the country, especially the High Plains and Midwest. Temperatures were 12-15 degrees Fahrenheit above normal for most of these two regions, with March 2012 one of the warmest on record. Most areas outside of the Pacific coast were above-normal. Wet conditions continued in portions of Kansas, Missouri, Arkansas, Oklahoma, Texas and Louisiana. The very non-La Niña-like winter helped to ease drought conditions from the historical levels of 2010-2011. Areas along the West Coast also received beneficial precipitation in March, helping to boost lagging seasonal totals, but they were still below normal for this time of year. Drought conditions improved slightly during the month, with 30.1 percent of the country in drought at the end of the month compared to 32.4 percent at the start of the month. Only 1.8 percent of the country was in D4 in late March, compared to 10 percent last July. The most intense areas of drought are lingering over portions of west Texas and eastern New Mexico and in the Southeast.



This time series chart showing the percent area of the western United States in drought from 2000 through the present shows an increase in abnormally dry and drought conditions over the winter.



This time series showing the area of Texas in abnormally dry or drought conditions from 2000 through the present shows recent improvement, but nearly 70 percent of the state still in moderate drought or worse.

Drought Affects Ag, Wildlife and Health

By Denise Gutzmer, Drought Impact Specialist, National Drought Mitigation Center

The NDMC entered 265 impacts into the Drought Impact Reporter in the first quarter of 2012. Texas continues to feel drought's lingering effects more than other states. East Texas has had good rains, easing drought's effects, but the western half continues to suffer. Despite dry conditions in the southeastern U.S., relatively few impacts have been reported so far. Farmers in the southern U.S. struggled to produce a crop in 2011, and for some, this year is not looking much better than last. Low soil moisture and reduced irrigation allocations present formidable challenges.

Drought in 2011 led ranchers to sell cattle, leading to the lowest cattle inventory in the U.S. since 1952, according to the U.S. Department of Agriculture.

Agriculture

Drought in 2011 led ranchers to sell cattle, leading to the lowest cattle inventory in the U.S. since 1952, according to the U.S. Department of Agriculture. On January 1, 2012, beef and dairy farmers owned 90.77 million head of cattle, which was 2.1 percent fewer cattle than the previous year. The number of beef cattle fell to its lowest point in 50 years at 29.88 million, after a decline of 3.1 percent over the year. The USDA anticipated that beef prices might climb another 5 percent in 2012 on top of a 10.2 percent price increase for beef in 2011. Meanwhile, livestock producers across the country were seeing higher prices for beef cattle since drought in Texas reduced the cattle population and demand for high-quality beef overseas led to more exports. The size of the cattle herd has been declining in recent years as fewer producers raise beef cattle.

The **Texas** AgriLife Extension Service announced that the state suffered $7.6 billion in agricultural losses in 2011 as extreme heat and strong winds dried out the land. Ranchers had little option but to sell livestock as pastures and stock ponds went dry and crops



Left: A black-tailed gnatcatcher in Texas. Photo by Francesco Veronesi. Middle: Whooping cranes in a marsh in Texas. U.S. Department of Agriculture photo by John Noll. Right: Migrating Snow geese on a farm pond in southeastern Nebraska. Photo by Wyatt Lanik.

failed in many areas. The previous record for drought damage in Texas occurred in 2006, when drought cost the agricultural sector $4.1 billion.

Water authorities and irrigation districts warned farmers in south central and western **Texas**, southern **New Mexico**, parts of **California** and southern **Oregon** to expect less water than usual. The Lower Colorado River Authority for the first time denied farmers along the Lower Colorado River water to irrigate rice, because lakes Travis and Buchanan upstream contained too little water. With reduced rice production, rice processing businesses were laying off employees. In southern **New Mexico** and near El Paso in **Texas**, farmers receiving water from two irrigation districts were expecting so little water that it would be very difficult to grow a crop.

Biologists noticed a number of unusual events among wildlife this winter.

Snowfall in the Sierra Nevada in **California** was below normal, precipitating reduced water deliveries. Agricultural producers in the San Joaquin Valley of California began requesting water deliveries in January to avoid crop damage and were expecting 30 percent of normal allocations unless conditions improved.

Society and Public Health

Prolonged, severe drought is bringing increased threats to human health in **Arizona**, **New Mexico** and **Texas** as officials document more frequent incidence of certain illnesses. Strong winds and more airborne dust and pollen were responsible for increased suffering among Texans with allergies and respiratory concerns. Aspergillosis, transmitted by airborne spores, as is Valley Fever, was a health concern near Wichita Falls, **Texas**, since people with compromised immune systems were more susceptible to it. The lack of rainfall allowed dust, pollens and fungal spores to remain in the air.

Rabies outbreaks were also attributed to drought in southeastern **New Mexico** and in **Texas** as animals came into closer contact at shared water sources. A rabies outbreak in Eddy County affecting 25 skunks, a fox and a dog, which all tested positive for rabies, may be related to drought, theorized the state public health veterinarian. Eight people were receiving treatment for rabies exposure in Eddy County. Thirty-two dogs were euthanized. Officials warned people in these areas to exercise caution near wild animals.

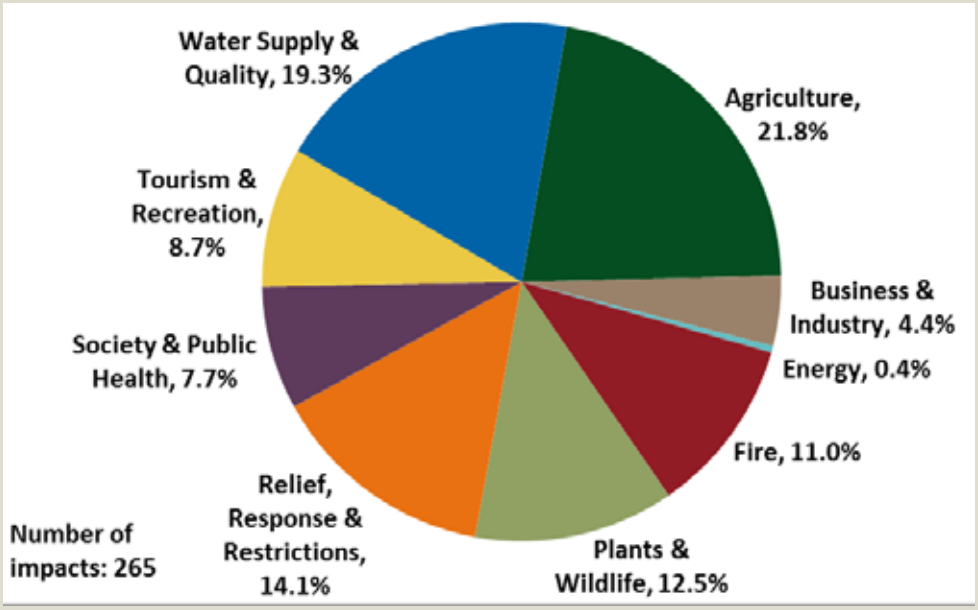
Plants and Wildlife

Biologists noticed a number of unusual events among wildlife this winter. Birds altered their wintering habits and stayed in areas less affected by drought, and other animals succumbed to illnesses. Bird migrations varied from the norm as drought in **Texas** pushed birds into other areas this winter. An annual bird count performed in December revealed that there were far fewer songbirds, waterfowl, catbirds, gnatcatchers, warblers and other migrating birds on the **Texas Gulf Coast** than usual. Normally tens of thousands of birds winter there. The area had 61 percent fewer geese, compared to the 19-year average. Populations of dabbling ducks were down 43 percent; diving ducks, 60 percent; and spoonbills, 74 percent. Ducks that normally winter in Texas extended their journeys south and spent the winter in Belize in Central America.

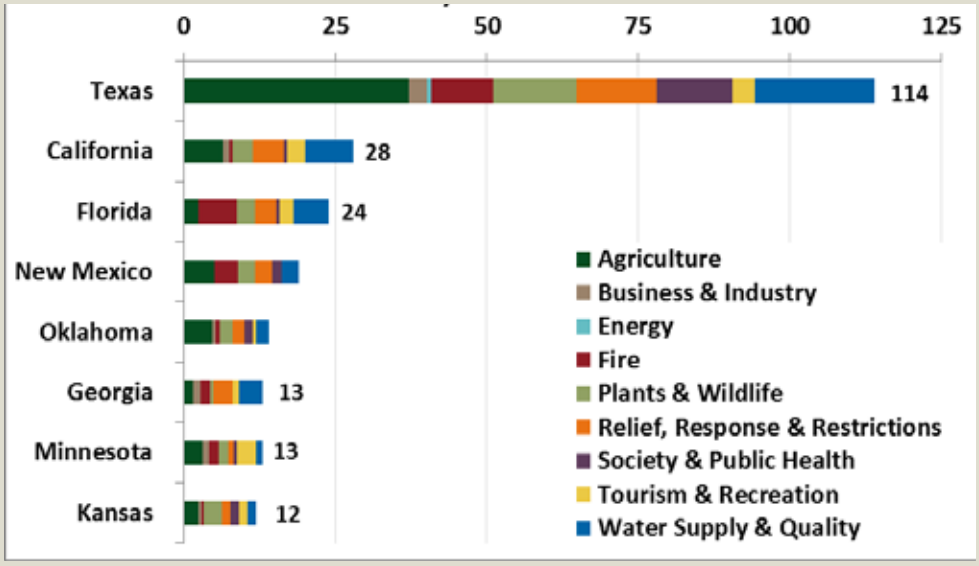
Approximately 5.6 million urban trees in Texas have perished from drought since 2011, according to survey results released by the Texas Forest Service in February. The TFS examined satellite images of urban areas to estimate the number of trees killed by drought in the past year. Tree experts noted that trees can continue to succumb to drought even after the drought ends.

Some endangered whooping cranes stayed in **Nebraska** for the winter instead of flying to San Antonio Bay on the Gulf Coast in **Texas**. Drought reduced the number of blue crabs and wolfberries that are staples in the cranes' diet.

Some birds of prey near Wichita Falls succumbed to Aspergillosis, a disease caused by airborne spores during drought. People with weakened immune systems are also susceptible to the disease.



This chart shows the proportion of impacts in each category that were entered into the Drought Impact Reporter in the first three months of 2012.



This chart shows the number of impacts, color-coded by category, for the eight states that were most affected by drought during the first three months of 2012.

More than 10,000 migrating waterfowl died from avian cholera at the Lower Klamath and Tule Lake National Wildlife refuges in northern **California** and southern **Oregon**. Insufficient water supplies forced the birds to crowd into a smaller area, allowing disease to spread. Low snowpack amounts and anticipated low flows into the Upper Klamath Lake led the U.S. Bureau of Reclamation to end water deliveries to the refuges in early December 2011.

Recreation and Tourism

Meager snowfall put a damper on skiing and other recreational activities in **Colorado**, **Nevada** and **California**. Dry conditions and delayed snowfall allowed golf courses in the Reno-Tahoe area to remain open many weeks later into the winter season than usual and entertain a record number of golfers. The absence of snow changed the range of recreational opportunities around Lake Tahoe. When businesses would normally rent skis and snowboards, warm temperatures and the dearth of snow led to continued demand for kayaks, mountain bikes and powerboat rentals. Visits to the China Peak Mountain Resort in Fresno County, **California,** were down by about 50 percent since little snow fell, leading to the production of artificial snow throughout the winter. The lack of snow this winter contributed to a 7.4 percent drop in visits to **Colorado** Ski Country's 22 member resorts through the end of February.

Low water levels led to the closure of the Dundee State Fish Hatchery in northern Texas because Lake Kemp was too low to ensure adequate water for operation. Other fish hatcheries in the state will make up for lost production of striped bass and hybrid striped bass.

Visiting Scholar Zhao Analyzes Meteorological and Hydrologic Drought in the Jinghe River Basin

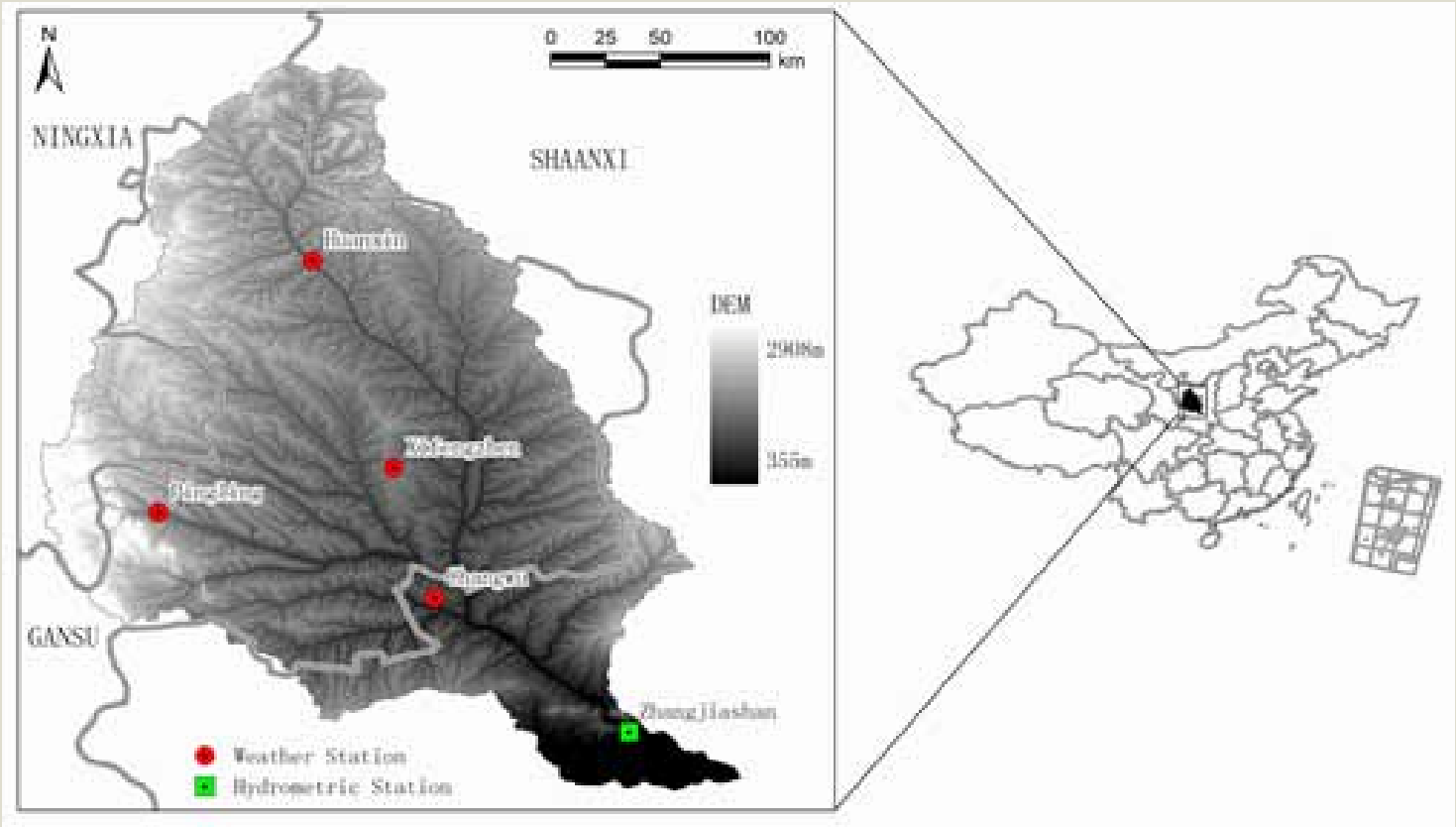
Lin Zhao, a Ph.D. student at the Academy of Disaster Reduction and Emergency Management at Beijing Normal University, returned to China on Feb. 28 after three months at the NDMC.

Zhao's research was the first to investigate the relationships between meteorological drought and streamflow in the Jinghe River Basin, a region dependent on rainfed agriculture, using data from 1970 to 1990. He found that streamflow drought lagged meteorological drought by about 112 days.

"The time lag between meteorological drought and hydrologic drought is very important," Zhao said. "You can manage hydrologic drought from the viewpoint of meteorological drought. This can be applied to other periods or other regions."

Zhao said his time at the NDMC provided a valuable opportunity to work face-to-face with other drought researchers, as well as an interval to focus on his studies without the social obligations of life at home. Zhao, who is originally from Chongqing, plans to complete his Ph.D. in June and to find a job at a university.

He made time in his final week at the NDMC to shop for Nebraska goods for friends and family back home. "I hope I can find another opportunity to come here after I graduate," he said. "The air is always clear."



This map shows the locations of weather stations and a streamflow station in the Jinghe River Basin, and the location of the basin within China.

Visiting Scholar Focuses on Drought Prediction

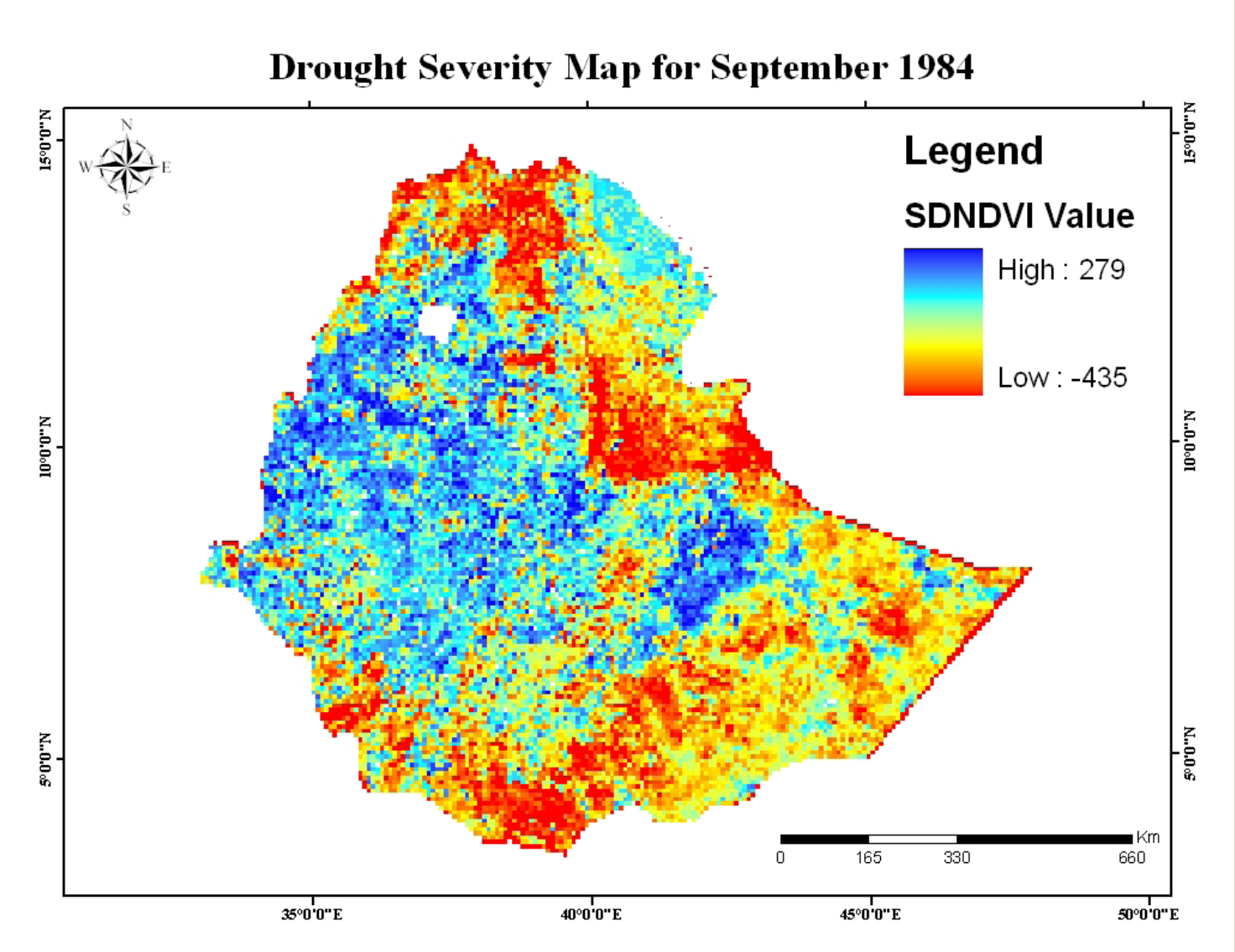
Getachew Berhan Demisse, a visiting scholar at the National Drought Mitigation Center from August 2011 to February 2012, returned to Ethiopia, where he planned to demonstrate his method for predicting drought up to four months ahead.

Getachew used his interdisciplinary background in forestry, information technology and geographic information systems to create an object-oriented approach to modeling drought, which is the subject of his dissertation.

He tested his model on historic data and found that it correctly anticipated severe droughts in Ethiopia in 1984 and in 2002.

Getachew said he found four key attributes that explain 85 percent of the variability between dry and wet years, and added seven more to the mix to explain up to 90 percent. The four main attributes included dynamic data — the three-month Standardized Precipitation Index (SPI) and the Normalized Differentiated Vegetation Index (NDVI) -- and static data -- a digital elevation model and the water holding capacity of the soil. The other seven were five oceanic indices, land cover, and ecological zones. Oceanic indices are long-term fluctuations in sea surface temperatures that scientists have connected to rainfall patterns over land.

The model was designed to run each month to produce predictions for the growing season ahead, at one-month intervals into the future, up to four months out.



September 1984 drought in Ethiopia shown using anisotropic diffusion

Getachew, a doctoral student in IT at Addis Ababa University, worked with Dr. Tsegaye Tadesse, NDMC climatologist, who is developing the Vegetation Drought Outlook (VegOut), and with Karin Callahan, NDMC GIS/Remote Sensing specialist. Getachew has a bachelor's degree in forestry from the Alemaya University of Agriculture, a certificate in computer science from Ethio Computer Training, and a master's degree in GIS and Earth Observation from the International Institute for Geo-information Science and Earth Observation in The Netherlands. He is a GIS lecturer at Addis Ababa University and at HilcoE School of Computer Science and Technology.

During his time in the U.S., Getachew worked with NDVI data from the National Oceanic and Atmospheric Administration and with data from USAID's Famine Early Warning System Network (FEWS NET). He said that upon returning to Ethiopia, instead of NOAA data, he would substitute data from a Meteosat Second Generation feed, available via a receiving station recently installed at his university by the European Union.

He tested his model on historic data and found that it correctly anticipated severe droughts in Ethiopia in 1984 and in 2002.

Getachew Berhan Demisse, in his office in Hardin Hall, reviews data on evapotranspiration from the U.S. Geological Survey, which helped fund part of his stay in the U.S.

The new data feed was part of the inspiration for Getachew's research. With the meteorological satellite data coming from the feed, "It's possible to look at your environment every 15 minutes," he said. "We thought, why not use this data for drought monitoring? That's a top agenda item for us."

Development and aid agencies use drought predictions to try to reduce the effects of food insecurity in areas where people depend on subsistence agriculture for their livelihoods.

Although the data isn't new, Getachew believes he has found the signal in the noise, having identified which data is meaningful, and he is bringing it together in a way that literally presents a clearer picture of areas affected by drought. Instead of the pixelated images that come from satellite data, he uses a technique called anisotropic diffusion to show patterns more clearly.

Getachew hopes to complete his doctorate in June. He looks forward to showing the product of his research – drought prediction maps -- to FEWS NET and to the Ethiopian Disaster Prevention and Preparedness Agency, and to seeing the central component of his research validated through the peer-review process.

"This is practical, problem-solving research," Getachew said. "It's on the top of the agenda in our country."

NDMC Works Around the World

The NDMC collaborates with meteorological services, agricultural agencies and drought planners to help improve food and water security around the world. Recent international activities include:

Mark Svoboda, NDMC climatologist, Drought Monitor author and Monitoring program area leader, is an invited External Advisory Board member for the European Union's project "Fostering European Drought Research and Science-Policy Interfacing (Drought R&SPI)," which met March 27-30 in Valencia, Spain.

The External Advisory Board of the European Union's Drought Research and Science-Policy Interfacing initiative visited Lake Albufera, south of the city of Valencia and near the Mediterranean Sea, and the municipal Arts and Sciences Complex.

Mike Hayes, NDMC director, is on the organizing committee for the Global Drought Information System Workshop that will be held in Frascati, Italy, April 11-13. Don Wilhite, founding director of the NDMC, will give a keynote presentation. Svoboda and Brian Fuchs, NDMC climatologist and Drought Monitor author, will both present posters.

Svoboda, Fuchs, and Brian Wardlow, a UNL School of Natural Resources geographer who is affiliated with the NDMC, will participate in the North American Drought Monitor Forum, April 18-20 in Cancun, Mexico.

Svoboda also provided a March 5 update on drought conditions along the U.S.-Mexico border for a Transborder Climate Adaptation webinar convened by CLIMAS at the University of Arizona, sponsored by NOAA's Climate and Societal Interactions program.

Hayes is on the Scientific Advisory Board for a large climate change-related project taking place in the Czech Republic called CzechGlobe, and will attend the first meeting of the Advisory Board May 14-15 in Mikulov, Czech Republic.

Svoboda will help conduct a drought monitoring, early warning and information system training workshop in the Caribbean, hosted by Jamaica, the week of May 21.

Hayes, Svoboda and Don Wilhite, NDMC founding director, will be in China, June 1-9, to participate in "Drought Monitoring, Assessing and Planning under Global Climate Change," a workshop at Beijing Normal University. They will also visit the Department of Water Hazard Research at the China Institute of Water Resources and Hydropower Research, the Beijing Climate Centre at the Chinese Meteorological Academy, the Center for Rural Environmental Social Studies, and the Institute of Sociology at the Chinese Academy of Social Sciences.

Wardlow's Work with NDMC to Continue in New Position

The NDMC is congratulating Brian Wardlow, who has accepted a tenure-track position as an associate professor and remote sensing scientist in the School of Natural Resources at the University of Nebraska-Lincoln. He'll be relocating within the same building and will maintain strong ties as a faculty fellow with the National Drought Mitigation Center, which is based in UNL's School of Natural Resources. Wardlow will continue to participate in several ongoing projects within the NDMC and also work with the Center on future research and applications to advance the application of geospatial technologies for drought monitoring and early warning in the United States and internationally.

During his time at the NDMC, from 2006 to 2012, Wardlow led the GIScience and Analysis Program Area. He worked with Tsegaye Tadesse, Karin Callahan, Chris Poulsen, Jess Brown at the U.S. Geological Survey's EROS Data Center, and others to develop the Vegetation Drought Response Index (VegDRI) and the Vegetation Outlook (VegOut) tools to monitor and anticipate drought. The GIScience and Analysis group also worked with NASA to begin publishing and distributing weekly maps showing changes in groundwater, root zone moisture and surface moisture, based on satellite data. They have also collaborated with U.S. Department of Agriculture scientists to develop remote sensing tools to monitor evapotranspiration (ET) in support of drought monitoring.

Wardlow recently edited a book with Martha Anderson, USDA Agricultural Research Service, and James Verdin, USGS and National Integrated Drought Information System, entitled *Remote Sensing of Drought: Innovative Monitoring Approaches*, which will be published by CRC Press in April 2012. The book details an array of new satellite-based tools now available to monitor key environmental conditions relevant to drought, such as ET, groundwater, precipitation, soil moisture, and vegetation health.

Wardlow has also worked on various remote sensing projects to characterize agricultural landscapes and monitor seasonal dynamics of vegetation, particularly crops. These activities included estimating crop phenology dates from satellites and at close range, developing classification strategies in collaboration with USGS EROS to map irrigated agricultural lands across the United States, and assessing whether satellite observations can be used to retrieve accurate estimates of specific crop conditions such as green leaf area index. Wardlow will continue to work in these remote sensing topical areas that have application in key areas such as drought, food security, and water resources. His specific research interests include land use/land cover mapping and monitoring, climate-vegetation interactions, biogeography, and remote sensing/GIS applications for agriculture and natural resource management and assessment.

Before joining the NDMC, Wardlow was a NASA Earth System Science graduate research fellow at the Kansas Applied Remote Sensing (KARS) program at the University of Kansas. While at

KARS, his dissertation research focused on the development of regional-scale crop mapping and monitoring protocol for the U.S. Central Great Plains using time-series MODIS 250-meter vegetation index data. Wardlow also worked as a remote sensing scientist for the National Land Cover Dataset (NLCD) program at EROS. Wardlow received a Ph.D. in 2005 in Geography from the University of Kansas, specializing in remote sensing and plant ecology, an M.A. in 1996 in Geography from Kansas State University, specializing in remote sensing and GIS, and a B.S. in 1996 in geography and geology from Northwest Missouri State University, specializing in environmental geography.

Latest IPCC Report Stresses Climate Adaptation to Reduce Disasters

The Intergovernmental Panel on Climate Change released the full version of its Special Report on Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation on March 28. The report underscores the need to plan ahead so that climate events such as droughts and heat waves don't become disasters.

"Evidence suggests that climate change has led to changes in climate extremes such as heat waves, record high temperatures and, in many regions, heavy precipitation in the past half century," the IPCC said in an accompanying press release. "Climate extremes, or even a series of non-extreme events, in combination with social vulnerabilities and exposure to risks can produce climate-related disasters."

Policymakers can avert disaster by implementing no-regrets measures that aid sustainable development, keep options open, and are beneficial regardless of the rate of climate change, the IPCC said. Policies that build resilience can keep an extreme climate event such as a heat wave or a drought from becoming a full-fledged disaster.

Mike Hayes, director of the NDMC, said he hoped that this latest IPCC report would boost public understanding that it is possible and necessary to prepare for drought and other hazards. "The Drought Center's mission is to reduce societal vulnerability to drought," he said. "A lot of people still think there's nothing we can do about drought, but they're wrong. We can't stop drought from occurring, but we can certainly take steps to protect ourselves, our communities, our ecosystems and our food and water supplies from some of the worst effects of drought."

This latest IPCC report is the product of interdisciplinary collaboration between climate scientists, experts in impacts, vulnerability and adaptation, and experts in disaster risk management.

Among other findings, the IPCC expressed medium confidence in a projected increase in duration and intensity of droughts in some regions of the world, including southern Europe and the Mediterranean region, central Europe, central North America, Central America and Mexico, northeast Brazil, and southern Africa.

Read the full report or the summary for policymakers online: *http://www.ipcc-wg2.gov/SREX/*